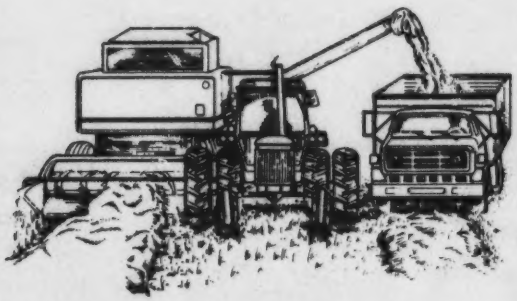
Saskatchewan Agriculture

Economics Branch

Farm Management



ECONOMICS OF STRAIGHT COMBINING

Foreword

Early users of combines in Western Canada practiced straight combining of their wheat. The number of combines in Western Canada increased from four in 1924 to 791 in 1927. With the introduction of swathers the number of combines in Western Canada jumped to 4,448 in 1928 and 8,562 in 1930[1]. The practice of straight combining meant a delay in the harvest because of uneven maturity of spring wheat and weed infested fields. Neighbours who used a binder and thresher started harvest earlier than those who straight combined. The invention of swathers enabled farmers to start swathing about the time the neighbours started cutting with the binder. The green kernels and weeds matured in the swath eliminating storage problems. The practice of straight combining was generally replaced by a system of swathing and picking up the swath with a combine.

The use of hot air dryers, natural air grain drying fans and shatter resistant varieties has sparked a renewed interest in straight combining.

In January, 1983, a survey of fifteen farms in northwestern Saskatchewan was conducted to gather information from operators who have had experience with straight combining. The survey participants were suggested by agricultural representatives in the area. The following survey results on page two, three and four summarize the views of the farm operators taking part in the survey. Two partial budgets indicate the economic advantages and disadvantages of straight combining and natural air drying of wheat.

This bulletin was prepared by the Farm Management Section of Saskatchewan Agriculture. Appreciation is extended to the farmers who participated in the survey and to those who reviewed the bulletin.

Farm Management Section
Saskatchewan Agriculture
January, 1987

[1] Custom Combining on the Great Plain, Thomas Isern

3M 02/87 ISBN 0-88656-455-7

All fifteen farmers surveyed on straight combining agreed that straight combining requires either a method of drying the grain or an outlet for tough grain. Twelve of the fifteen farmers swath a portion of their crops. Each combine in the survey harvested an average of 1,447 acres in 1982. 782 acres or 54% of the total acres were straight combined. Research indicates that combining at high kernel moisture will reduce natural, reel and cutter bar losses. Research indicates that cutting and shattering losses increase rapidly if wheat is left in the field after it reaches 14% moisture. Combining wheat at high moisture results in reduced cracking of grain and reduced shoe losses. Increased speed of straight combining results in reduced combine costs per acre. Retaining kernel moisture using a natural air drying system can increase net income.

Budgets show that when straight combining 782 acres, which was the average in the survey, it would pay to purchase a straight cut header if you already owned a self propelled combine. It would not pay to convert to a self propelled combine in order to straight combine 782 acres. Straight combining more acres would spread the fixed costs of the added investment in the self propelled combine and header over more acres. Straight combining more than 1,564 acres would pay for the additional investment in a self propelled combine and straight cut header.

Results of Partial Budgets

	Advantages ($/ac.)	Disadvantages ($/ac.)	Net Benefit ($/ac.)
Partial Budget #1 - straight combine wheat tough and natural air dry - purchase a straight cut header for $12,094 - install natural air grain drying equipment in bins	+11.71	−8.51	+3.20
Partial Budget #2 - straight combine wheat tough and natural air dry - trade P.T.O. combine on a S.P. combine with additional investment of $40,000 - purchase a straight cut header for $12,094 - install natural air grain drying equipment in bins	+11.71	−17.68	−5.97

Straight Combining Survey - Northwestern Saskatchewan

- 15 farm units surveyed
- 15 combines used in 1982 (14 self-propelled, 1 P.T.O.)
- 21,705 acres total crop in 1982
- 11,730 acres straight combined in 1982

1. Machinery Purchased

	Average	High	Low
- straight cut headers purchased in 1982 (12)	$7,975	$10,000	$3,000
- purchase of parts to install knife and reel (2)	$1,650	$1,800	$1,500
- width of straight cut header	21 ft.	30 ft.	13 ft.
2. Machinery Sold - None			
3. Experience with Straight Combining	3.6 yrs.	21 yrs.	1 yr.
4. Percent of total crop straight combined in 1982 $\frac{11,730 \text{ acres}}{21,705 \text{ acres}}$ =	54%	100%	10%
5. Percent of all wheat straight combined in 1982 $\frac{9,130 \text{ acres}}{15,151 \text{ acres}}$ =	60%	100%	0%
6. Percent of all barley straight combined in 1982 $\frac{1,690 \text{ acres}}{3,050 \text{ acres}}$	55%	100%	0%
7. Other crops straight combined in 1982: Peas, Lentils (desiccated), Canola & Rye			
8. Straight combining faster than picking up by (6 farmers)	20%	50%	−10%

9. Four of the fifteen farmers cut out green spots, the rest didn't mainly because they were using a hot air dryer or natural air drying.

10. Of the thirteen farmers that straight combined in 1982 each had either a method of drying or an outlet for tough grain:

    - 6 farmers had natural air drying fans
    - 2 farmers had a hot air dryer
    - 4 farmers had both a hot air dryer and natural air drying fans
    - 1 farmer fed tough grain to livestock

Advantages of Straight Combining

- No swathing cost
- Reduced labour requirements (swathing and trucking)
- Pickup losses eliminated
- Start combining earlier in the morning
- Cleaner grain (less dust)
- Can start straight combining and drying about the same time you would normally start picking up swathed grain
- Straight combining increases the acres per hour harvested by 20% over picking up a swath
- Reduced losses when straight combining a short crop
- No blowing of swaths

- Reduced combine repair and fuel costs - reduced load because less straw put through the combine
- Can cut out different grades of grain in the same field (i.e. green spots)
- Can cut high for snow trapping
- Shelling losses not a problem
- Reduced wildlife losses (ducks don't land in standing crop)
- Grain sprouting in swaths eliminated
- Reduced grade loss resulting from rain
- Standing grain dries faster after a rain
- Less dockage in grain
- Can cut above second growth green heads
- Lower trucking cost
- Can cut the field so the combine returns to the truck with a full hopper.

Disadvantages of Straight Combining

- Standing grain may get tough earlier on a damp evening than swathed grain
- Need a self propelled combine to get a straight cut header wider than 17 feet
- Shelling of some varieties (Sinton Wheat)
- Green kernels can cause storage losses
- If the crop is frozen it takes longer to mature when standing
- Hail will reduce yield more in standing crop
- Snow may lodge grain requiring use of pickup guards and pickup reel which may reduce speed to 50% of normal

Other Management Considerations

- Should have some means of drying if straight combining, either hot air or natural air drying fans.
- Livestock may be used to dispose of tough grain
- It may cost more to work in the long standing straw. Long straw is more of a problem if seeding with drills than a cultivator and air seeder.
- If it gets late in the year it may be best to swath everything
- Reel height is important in straight combining especially when cutting high for snow trapping
- Reasons given for starting straight combining
  - to cut above chickweed in a badly infested field
  - to cut above second growth green heads
  - to reduce labour requirements
  - to eliminate one combine
  - to reduce the work load in harvesting
  - to harvest crops on breaking
  - reduced grade losses
  - purchased straight cut header for $10,000 rather than invest $25,000 in a new self-propelled swather
  - to combine short stubble wheat
  - to combine flax
  - the best wheat variety was Neepawa - very little shelling.

The following Partial Budgets compare the cost advantages and disadvantages between swathing at 35% moisture and windrow combining versus straight combining at 20% moisture and natural air drying.

PARTIAL BUDGET #1 - A straight cut header is purchased for a self propelled combine and natural air drying equipment is installed in 3,300 bushel bins.

PARTIAL BUDGET #2 - A pull type combine is traded on a self propelled combine of the same size and a straight cut header is purchased. Natural air drying equipment is installed in 3,300 bushel bins.

PARTIAL BUDGET #1 - Straight Combining Wheat Tough and Natural Air Drying
Purchasing a Straight Cut Header for a S.P. Combine

Disadvantages		Advantages	
Added Costs		**Added Returns**	
(1) Annual cost of straight cut header	$2.77/ac.	(6) Pickup loss eliminated .37 bu/ac x $3.50/bu	$ 1.30/ac.
(2) Annual cost of natural air drying 1 cfm/bu. 3300 bu. bin 30 bu./ac. x 11.81/bu.	3.54/ac.	(7) Reduced combine loss harvesting high moisture wheat .73% x 30 bu/ac x $3.50	.77/ac.
(3) Moving grain when average dry $99.69 -: 3300 bu. x 30 bu./ac.	.91/ac.	(8) Reduced cracking loss harvesting high moisture wheat 1.5% x 30 bu/ac x $3.50	1.58/ac.
Reduced Returns		(9) Retain kernel moisture at 14.5% rather than 13.5% 4.03/bu x 30 bu/ac.	1.21/ac.
(4) Increased Natural or Shelling Loss	.98/ac.	(10) Reduced Grade loss	?
(5) Increased Reel and cutter Bar Loss	.31/ac.	**Reduced Costs**	
		(11) Cost of Swathing	3.75/ac.
		(12) Increased Speed of Combining	3.10/ac.
TOTAL DISADVANTAGES	$8.51/ac.	TOTAL ADVANTAGES	$11.71/ac.
		The net advantage is $3.20 per acre plus any reduced grade loss.	

Added Costs

(1) **Annual cost of a Straight Cut Header**

Average cost of a new straight cut header is $12,094

- survey: 24 ft. JD, MF, C-IH

Average acres straight cut 1 combine in 1982 - 782 acres

- survey: page 2

Depreciation

$$= \frac{\text{original cash cost - 10\% original cash cost}}{\text{\# years use}}$$

$$= \frac{12{,}094 - 1{,}209.40}{13 \text{ years}} = 837.28$$

Investment

$$= \frac{\text{original cash cost} + 10\% \text{ original cash} \times \text{interest rate}}{2}$$

$$= \frac{12{,}094 + 1{,}209.40 \times 10\%}{2} = 665.17$$

Insurance and housing	= 12,094 x 1%	= 120.94
Repairs	= 12,094 x 4.5%	= 544.23
Total annual cost		2,167.62
Annual cost/acre (782 acres)		$2.77/acre

(2) **Annual Cost of Natural Air Grain Drying**

- 1 cfm/bu. air flow
- drying wheat from 18.5% to 14.5% moisture
- 3300 bu. bin
- cost of 5 h.p. fan and screen - 2276

Depreciation

$$= \frac{2276 - 227.60}{15} = \$136.56$$

Investment

$$= \frac{2276 + 227.60}{2} \times 10\% = 125.18$$

Insurance - 2276 x 1%	= 22.76
Repairs - 2276 x 3%	= 68.28
Electricity 5 h.p. x 750/1000 watts = 3.75 kw x .0395 x 250 hrs.	= 37.03
	389.81
Total 389.81 + 3,300 bu	= 11.8¢/bu

(3) **Moving Grain When Average Dry**

2 augers x 3.3 hr x $9.65	= 63.69
labour 4 hrs. x $9.00/hr	= 36.00
TOTAL	= 99.69
99.69 + 3,300 bu x 30 bu/ac	= $.91/ac

Reduced Returns

M.E. Dodds of the Agriculture Canada Research Station at Swift Current conducted a study of "Grain Losses In the Field When Windrowing and Combining Wheat." The study was performed in a field of chinook wheat. Swathing started when grain was in the early dough stage and continued on consecutive days weather permitting, until the grain was ripe. Eight replicates of the test were used from 1961 to 1964 inclusive and 4 replicates in 1965.

Four separate types of grain losses were determined on each plot:

1) natural loss prior to swathing;

2) reel and cutter bar loss;

3) pickup loss; and

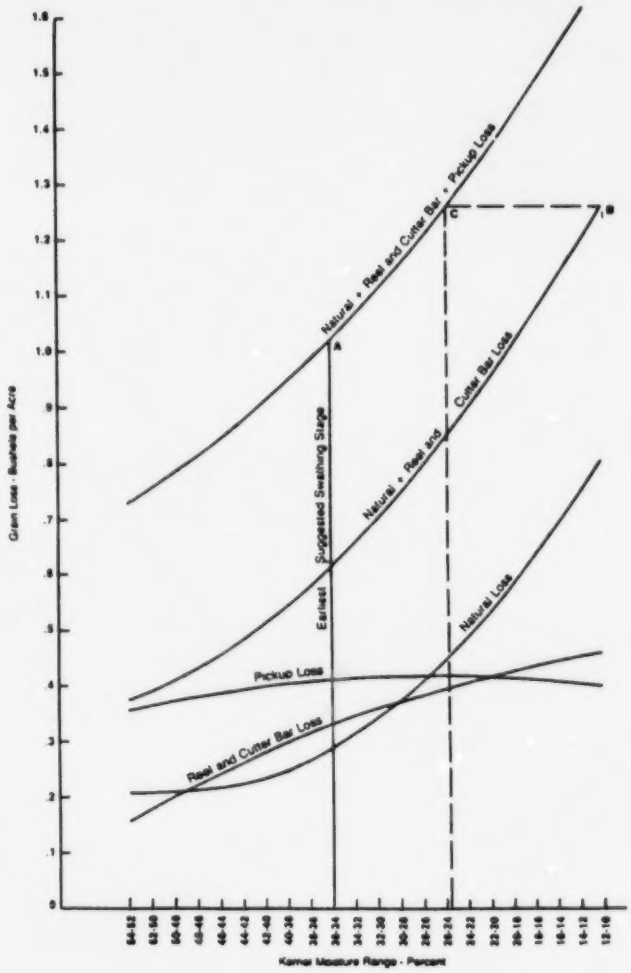
4) threshing and separating loss.

The natural loss increased rapidly as the standing grain matured and was the largest single loss in the field at harvest (figure 1). The loss caused by the reel and cutter bar occurred when the grain was cut with the swather or the combine. This loss increased as the crop matured but at a decreasing rate.

Pickup losses did not change much throughout the moisture range. The loss of grain from threshing and separating was calculated over four harvest seasons and found to be less than .1 bushels per acre.

Figure 1

Trends of Natural and Mechanical Losses of Wheat When Harvested at Different Stages of Maturity
- M. E. Dodds



Data Calculations from Figure 1 (bushels)

	natural	reel and cutterbar	pickup	total
swathed 35% and combined 14%	.28	.32	.38	.98
swathed 28% and combined 14%	.39	.38	.41	1.18
straight combined 20%	.55	.40	-	.95
straight combined 14%	.73	.45	-	1.18

The study indicates that for equal losses (Line B-C, figure 1) wheat shouldn't be swathed after the kernel moisture reaches 24%. Dodds indicates that research and experience have proven that 20% moisture is a more realistic stage at which to stop swathing and leave the crop for straight combining.

Note that straight combining at 20% moisture has a .03 bushel total advantage over swathing at 35%. Also note swathing at less than 28% moisture will have higher total losses than straight combining at 14%. The advantage of early swathing and early straight combining results from reduced natural loss plus reduced reel and cutter bar loss.

Dodd's data is contradicted by John Clarke of the Agriculture Canada Research station at Swift Current. He compared swathing at 35% moisture to straight combining at 14% moisture and to straight combining three weeks after the crop reached 14% moisture.

FIGURE 2

Losses of Windrowing Versus Straight Combining - John Clarke
Unpublished Data from the Agriculture Canada Research Station, Swift Current

Loss as Percent of Yield

	Windrow at 35% Moisture*	Direct Combine At 14% Moisture+	Direct Combine 3 Weeks After Crop Reached 14% Moisture
1980 Canuck	1.1	2.8	
1981 Canuck	1.1	0.9	4.0
Neepawa	0.5	0.6	2.8
Sinton	0.8	1.0	7.2
Wakooma	0.9	1.1	2.2

* Pickup, cut and shattering losses
\+ Cutting and shattering losses

The above table shows that losses increase dramatically when wheat is straight combined three weeks after it reaches 14% moisture. Clarke's 1981 data indicates that losses from the swathing system were .1% less (.03 bushels on a 30 bushel crop) than straight combining of Neepawa wheat at 14% moisture.

Since Dodd's and Clarke's data contradict by the same .03 bushels/acre, our budgets will estimate the higher natural and reel and cutter bar losses from straight combining at 20% are offset by the reduction in pick-up loss from the swathing system.

Therefore adjusted budget estimates for losses are:

Straight Combining
- Natural or Shelling Loss −.28
- Reel and Cutter Bar Loss −.09

Windrow Combining
- Pick-up Loss −.37

(4) **Natural or Shelling Loss**

Figure 1 shows a natural loss of .45 bu/acre (.73-.28) while the grain matured from 35% to 14% moisture. However, if the grain is straight combined at 20% moisture and natural air dried, the natural loss is reduced to .27 bu/acre (.55-.28).
Adjusted estimate .28 bu/acre x $3.50/bu = $.98/acre

(5) **Reel and Cutter Bar Loss**

Figure 1 also shows the reel and cutter bar loss is .08 bu/acre (.40-.32) while grain dries from 35% to 20% moisture.

Adjusted Estimate .09 bu/acre x 3.50/bu = .31/acre

Note that at 21% moisture, reel and cutter bar loss for straight combining equals the pickup loss for windrow combining.

ADVANTAGES

Added Returns

(6) **Pickup Loss Eliminated**

Pickup losses following swathing did not change much throughout the moisture range. Dodd's data shows a .38 bu/acre loss at the 14% moisture level.

Adjusted Estimate .37 bu/acre x 3.50 = $1.30/acre

(7) **Reduced Combine Losses When Threshing Tough Neepawa Wheat**

PAMI report #R180, January 1981 was comparing a standard combine to a Stueckle modified combine. The results showed reduced combine losses in tough Neepawa wheat as compared to dry Neepawa wheat when the combine is in good condition and well-adjusted. The losses from the standard combine are itemized in Figure 3.

Figure 3

Reduced Combine Losses When Threshing Tough Neepawa Wheat
(Standard Combine Losses in bu./hr.)

Type of Loss	Dry Neepawa Wheat	Tough Neepawa Wheat
Walker	1 bu./hr	1 bu./hr.
Shoe	3	1
Unthreshed Grain	2	2
Cracked Grain	17	7
Total	23 bu./hr.	11 bu./hr.

Total Loss as a Percent of Threshed Grain:

$$\frac{23 \text{ bu./hr.}}{277 \text{ bu./hr.}} \times 100 = 8.3\% \qquad \frac{11 \text{ bu./hr.}}{289 \text{ bu./hr.}} \times 100 = 3.8\%$$

Shoe Loss as a Percent of Threshed Grain:

$$\frac{3 \text{ bu./hr.}}{277 \text{ bu./hr.}} \times 100 = 1.08\% \qquad \frac{1 \text{ bu./hr.}}{289 \text{ bu./hr.}} \times 100 = .35\%$$

Cracked Grain as a Percent of Threshed Grain:

$$\frac{17 \text{ bu./hr.}}{277 \text{ bu./hr.}} \times 100 = 6.14\% \qquad \frac{7 \text{ bu./hr.}}{289 \text{ bu./hr.}} \times 100 = 2.42\%$$

In the PAMI test, other than cracked grain, the only difference between tough and dry grain was the shoe loss. Combining Neepawa tough resulted in a reduced shoe loss of 1.08% – .35% = .73%.

(8) **Reduced Cracking Loss When Harvesting High Moisture Wheat**

In the PAMI test (Figure 3), combining Neepawa tough rather than dry with a standard combine resulted in a reduction of cracked grain of 3.72% (6.14%-2.42%). Although these figures are high for the average farm situation, they stress the fact that extreme cracking loss under dry conditions can be substantially reduced when grain moisture is high.

Harrison (Figure 4) calculated reduced grain damage of 1.5% (2.0%-.5%) when combining wheat at 20% rather than 12%. Harrison appears to be more in line with the actual grain damage on most farms.

1.5% x 30 bu/ac x $3.50/bu - $1.58/ac

Effects of Moisture Content on Threshing - HP Harrison 1975 Park Wheat

Figure 4

Moisture	Grain Damage % of Total
12%	2.0%
16%	1.0%
18%	1.5%
20%	.5%

(9) **Retaining Kernel Moisture**

Wheat at 14.5% moisture is purchased by grain companies for the same price as wheat at 10.5% moisture. 14.5% moisture wheat weighs more than 10.4% moisture wheat so it is beneficial to sell your grain at the highest allowable moisture. By combining at high moisture and drying to 14.5% moisture you can ensure that your grain is not over dry. You may want to combine some grain tough; cool it, and mix it later with over dry grain. For example, a bin of 16.5% moisture wheat could be mixed with a bin of 12.5% moisture wheat to yield an average moisture of 14.5%. Your elevator agent may want you to haul the bins in separately so he can mix the two in the elevator to ensure proper mixing.

The difference in value of $3.50/bu wheat at 14.5% and 13.5% moisture is 4.03/bu.

At 14.5% in one bushel there is:

Water 60 lbs. x .145 = 8.7 lbs.
Dry Matter 60 lbs. - 8.7 lbs. = 51.3 lbs.

After drying to 13.5% moisture that bushel weighs:

$$\frac{\text{lbs. dry matter in 14.5\% wheat}}{\text{\% dry matter in 13.5\% wheat}} = \frac{51.3 \text{ lbs.}}{.865} = 59.31 \text{ lbs.}$$

Loss in weight is 60 lbs. - 59.31 lbs. = .69 lbs.

The loss in value in $\frac{.69 \times \$3.50/\text{bu}}{60 \text{ lbs.}}$ = 4.03/bu

(10) **Reduced Grade Losses**

Grade losses are caused by adverse weather conditions and the possibility of a loss in grade occurring becomes greater, the longer the crop remains in the field. Combining at high grain moisture and drying will advance the date of combining over combining at low grain moisture levels. Advancing the date of combining reduces the chance of grade losses.

The following table shows the value that is lost when #1, 13.5% wheat drops to #2, or when #2 wheat drops to #3:

Figure 5

Average Spread Between Grades of Spring Wheat
(dollars per bushel)

Grades Spread	1985-86	1984-5	1983-4	1982-3	1981-2	Average 5 Years
1CW to 2CW	$.22	$.26	$.24	$.27	$.19	$.24
2CW to 3CW	.22	.34	.32	.19	.25	.26

Some farm operators have experienced reduced grade losses by straight combining and drying grain. If frost occurs before the standing grain is mature the grade of the standing grain could be reduced.

Reduced Costs

(11) **Cost of Swathing**

Source is 1986 Farm Machinery Custom and Rental Rate Guide - $3.75/acre.

(12) **Increased Speed of Straight Combining**

A 20% increase in speed results in 20% more acres per hour. The following calculations include all combine costs including labour for a self propelled combine with 14,000 - 17,000 square inches separating area.

Source is 1986 Farm Machinery Custom and Rental Rate Guide

$$\text{Total Cost Per Acre Picking Up} = \frac{\text{Total Cost}}{\text{Acres/hour}} = \frac{158.07/\text{hr.}}{8.5\ \text{ac./hr.}} = 18.60/\text{acre.}$$

Straight combining increases the acres per hour by 20% to 10.2 ac./hr.

$$\text{Total Cost Per Acre Straight Combining} = \frac{\text{Total Cost}}{\text{Acres/hour}} = \frac{158.07/\text{hr.}}{10.2\ \text{ac./hr.}} = 15.50$$

Savings per acre due to increased speed of straight combining = $18.60/ac - $15.50/ac. = $3.10/ac.

PARTIAL BUDGET #1 summary shows a $3.20/ac advantage to purchase a straight cut header, combine at 20% moisture and natural air dryer as compared to the swathing and combining alternative. Additional advantage may be gained whenever grade loss is considered.

PARTIAL BUDGET #2 - Straight Combining Wheat Tough and Natural Air Drying
- Trading a PTO Combine on a SP Combine
- Purchase of a Straight Cut Header.

Disadvantages		Advantages	
Added Costs		**Added Returns**	
(13) Annual cost of added investment of $52,094 in S.P. combine and straight cut header	11.94/ac.	(6) Pickup loss eliminated .37 bu./ac. x 3.50/bu	$1.30/ac.
(2) Annual cost of natural air drying 1 cfm/bu 3300 bu bin. 30 bu./ac. x 11.81/bu	3.54/ac.	(7) Reduced combine loss harvesting high moisture wheat .73% x 30 bu./ac. x 3.50	.77/ac.
(3) Moving grain when average dry 99.69 - 3300 bu. x 30 bu./ac.	0.91/ac.	(8) Reduced cracking loss harvesting high moisture wheat 1.5% x 30 bu./ac. x 3.50	1.58/ac.
Reduced Returns		(9) Retain kernel moisture at 14.5% rather than 13.5% 4.03/bu. x 30 bu./ac.	1.21/ac.
(4) Natural or shelling loss	.98/ac.	(10) Reduced grade loss	?
(5) Reel and cutter bar loss	.31/ac.	**Reduced Costs**	
		(11) Cost of swathing	3.75/ac.
		(12) Increased speed of combining	3.10/ac.
Total Disadvantages	17.68/ac.	Total Advantages	11.71/ac

The net disadvantage is $5.97 per acre less any reduced grade loss.

(13) Annual cost of added investment of $40,000 in a SP combine and $12,094 in a straight cut header

Depreciation	$\frac{\$52,094 - \$5,209}{13 \text{ yrs.}}$	$3,606
Investment	$\frac{\$52,094 + \$5,209}{2} \times 10\%$	2,865
Insurance and Housing	$52,094 x 1%	521
Repairs	$52,094 x 4.5%	2,344
Total Annual Costs		$9,336
$9,336 ÷ 782 ac. =		$11.94/ac.

Partial Budget #2 summary shows the net effect is a disadvantage of $5.97 when straight combining 782 acres. In order to break-even:

(a) The gain in grade must exceed $5.97/ac.

$5.97 ÷ 30 bu/ac. = .20/bu

(b) The annual cost of the added investment for the S.P. combine and header must be reduced to $5.97/acre (11.94-5.97). To achieve this the additional costs must be spread over more acres.

$\frac{\$9,336}{\$\ 5.97}$ = 1564 acres

If more than 1564 acres were straight combined there would be a net benefit to the purchase of a S.P. combine and header.

Conclusions

All fifteen farmers surveyed on straight combining agreed that straight combining requires either a method of drying the grain or an outlet for tough grain. Twelve of the fifteen farmers swath a portion of their crops. Each combine in the survey harvested an average of 1447 acres in 1982. 782 acres or 54% of the total acres were straight combined. Research indicates that combining at high kernel moisture will reduce natural, reel and cutter bar losses. Research indicates that cutting and shattering losses increase rapidly if wheat is left in the field after it reaches 14% moisture. Combining wheat at high moisture results in reduced cracking of grain and reduced shoe losses. Increased speed of straight combining results in reduced combine costs per acre. Retaining kernel moisture using a natural air drying system can increase net income.

Budgets show that when straight combining 782 acres, which was the average in the survey, it would pay to purchase a straight cut header if you already owned a self propelled combine. It would not pay to convert to a self propelled combine in order to straight combine 782 acres. Straight combining more acres would spread the fixed costs of the added investment in the self propelled combine and header over more acres. Straight combining more than 1564 acres would pay for the additional investment in a self propelled combine and straight cut header.